What is claimed is:

1. A method for manufacturing a semiconductor substrate, comprising the step of:

forming a first buffer Si layer on a substrate having a silicon surface;

epitaxially growing, in sequence, a first strained SiGe layer and a first Si layer above the first buffer Si layer;

implanting ions into the resulting substrate followed by annealing so as to relax the lattice of the first strained SiGe layer and to thereby providing tensile strain in the first Si layer; and

epitaxially growing, in sequence, a second buffer Si layer and a second SiGe layer above the first Si layer; and forming a second Si layer having tensile strain on the second SiGe layer.

2. The method for manufacturing a semiconductor substrate of claim 1, further comprising, after tensile strain is provided in the first Si layer and before the second buffer Si layer is formed on the rezulting substrate, washing the first Si layer to reduce the concentration of residual oxygen existing on the surface of the first Si layer.

3. The method for manufacturing a semiconductor substrate of claim 1 wherein the concentration of residual oxygen existing on the surface of the first Si layer is no greater than 1×10^{16} cm^{-3} after washing.

4. The method for manufacturing a semiconductor substrate of claim 1 wherein the first strained SiGe layer is no greater than the critical film thick.

5. The method for manufacturing a semiconductor substrate of claim 4 wherein the first strained SiGe layer is 10 to 300 nm thick.

6. A semiconductor substrate comprising a first buffer Si layer, a first SiGe layer, a first Si layer having tensile strain, a second buffer Si layer, a second SiGe layer and a second Si layer having tensile strain formed in this order above a substrate having a silicon surface,

wherein the oxygen concentration at the interface between the first SiGe layer and the first Si layer, the interface between the first Si layer and the second buffer Si layer and/or the interface between the second buffer Si layer and the second SiGe layer is no greater than 1×10^{16} cm^{-3}.

7. The semiconductor substrate of claim 6 wherein the first SiGe layer is no greater than the critical film thick.

8. The semiconductor substrate of claim 7 wherein the first SiGe layer is 10 to 300 nm thick.

9. A semiconductor device comprising a semiconductor substrate having, in the following order, a first buffer Si layer, a first SiGe layer, a

first Si layer having tensile strain, a second buffer Si layer, a second SiGe layer and a second Si layer having tensile strain above a substrate having a silicon surface; a gate electrode formed above the semiconductor substrate of the second Si layer side via a gate insulating film; and a source and a drain formed in the surface layer of the semiconductor substrate of the second Si layer side,

wherein the total film thickness of the first SiGe layer and the second SiGe layer is set at a value that is not less than the width of a depletion layer, which expands when voltage is applied to the drain.

10. The semiconductor device of claim 9 wherein residual oxygen concentrations at the interface between the first SiGe layer and the first Si layer, at the interface between the first Si layer and the second buffer Si layer, and at the interface between the second buffer Si layer and the second SiGe layer are 1×10^{16} cm^{-3}, or less.

11. The semiconductor device of claim 9 wherein the combined film thickness of the first SiGe layer and the second SiGe layer is 200 to 600 nm.